Patent Application

Atty. Docket No.: 3493.00122
Client Ref. No. 1999-0681

I/We Claim:

1.   A data mirroring system, comprising:

a local site at a first location comprising:

    a server; and

    a mirror controller; and

at least two remote mirror sites, each at different geographic locations, wherein each location is other than the first location, and wherein each remote mirror site comprises:

    a disk array controller; and

    means for storing data;

wherein said local site is communicatively coupled to each remote mirror site.

2.   The system of claim 1, wherein each of said at least two remote mirror sites further comprise a cache.

3.   The system of claim 1, the local site further comprising:

a storage area network (SAN).

4.   The system of claim 1, the local site further comprising:

a cache; and

means for storing data.

5.   The system of claim 1, wherein at least one of said at least two remote sites is geographically displaced at least twenty-five miles from the local site.

6.   The system of claim 1, wherein said at least two remote sites further comprising exactly two remote sites.

7.   The system of claim 6, wherein said remote sites are substantially diametrically opposed to each other, and said remote sites are geographically located at least approximately 25 miles apart.

8.   The system of claim 1, further comprised of:

a backup site comprising a backup mirror controller and a backup server, and adapted to being operational when the local site ceases normal functions.

9.   The system of claim 8, said backup site further comprising:

a cache; and

a means for data storage.

10.   A method of data mirroring to insure the continuity of data, said method comprising the steps of:

(i)   receiving a data write request at a primary mirror controller;

(ii)   sending the data write request to each of at least two remote mirror sites;

(iii)   receiving an acknowledgement message (ACK) from each remote mirror site, wherein each ACK comprises information that the data write request has been received and executed by the remote mirror site for which the ACK corresponds; and

(iv)   sending an ACK that the data write request has been completed.

11.   The method of claim 10, wherein each of said remote mirror sites is adapted to write the data write request to a cache and to a remote storage means.

12.   The method of claim 10, further comprising the steps of:

(v)   upon completion of step (i), writing the data write request to a cache connected to the primary mirror controller; and

(vi)   upon the completion of step (iii), removing the data write request from the cache connected to the mirror controller.

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13.   The method of claim 10, further comprising the steps of:

(v)   detecting an interruption of service by the primary mirror controller;

(vi) switching to a secondary mirror controller;

(vii) performing steps (i) – (iv) substituting the secondary mirror controller in place of the primary mirror controller.

14.   A wide-area cascade system for data mirroring, comprising:

a local site adapted to generate a data write request;

a remote mirroring site adapted to accept and perform said data write request; and

a relay chain comprising at least one relay point, said relay chain located between said local site and said remote mirroring site, said relay point(s) adapted to forward the data write request(s) to one of the next relay point or the remote site, and to send an acknowledgment message back to one of the previous relay or the local site.

15.   The system of claim 14, wherein the local site is comprised of:

a server adapted to generate said data write request;

a storage subsystem comprising:

   a disk array controller adapted to receive the data write request from the server and to forward the data request to the first relay.

16.   The system of claim 15, wherein the storage subsystem further comprises:

a cache; and

a means for storing data;

wherein said disk array controller being further adapted to write the data write request to the cache and to perform the data write request on the means for storing data.

17.   The system of claim 14, wherein the remote site comprises:

a cache;

means for storing data;

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a remote disk array controller adapted to receive the data write request from the relay immediately preceding the remote site, to write the data write request to the cache, and to perform the data write request on the means for storing data.

18. The system of claim 14, wherein at least one of the at least one relays comprises:

a cache;

a means for storing data;

a relay disk array controller, adapted to receive the data write request(s) from the local site, to write the data write requests to the cache, to forward the data write request(s) to one of the next relay or the remote site, and to perform the data write requests on the means for storing data.

19. A method of mirroring data, comprising the steps of:

(i) generating a data write request at a local site;

(ii) sending the data write request through a relay system comprised of at least one relay point;

(iii) receiving the data write request at a remote mirror site;

(iv) writing the data write request to a memory; and

(v) sending an acknowledgement message to the relay system.

20. The method of claim 19, wherein each of said at least one relay point performs the steps of:

(a) writing the data write request to a relay point cache;

(b) sending an acknowledgment message back to one of a previous relay point and the local site; and

(c) sending the data write request to one of a next relay point and a remote mirror site.

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21.   The method of claim 20, further including the step of removing the data write request from each relay point cache as each relay receives the acknowledgment message.